

WHAT IS CLAIMED IS:

1. A proportional solenoid valve comprising:
an input port to which a fluid is supplied;
an output port that communicates with the input port;
a drain port from which a part of the fluid supplied to the input port is discharged;

a cylindrical valve seat member that includes an input/output-side passage provided between the input port and the drain port and between the output port and the drain port, a seat portion that is provided in an end portion of the input/output-side passage, and a drain-side passage provided between the seat portion and the drain port;

a ball-shaped valve element that is brought into and out of contact with the seat portion; and

a valve drive portion that includes a coil and displaces the valve element in accordance with a current applied to the coil, thereby changing an amount of the fluid flowing from the input/output-side passage to the drain port through the drain-side passage and changing an output pressure from the output port,

wherein the drain-side passage is formed by exhaust passage holes whose number is an even number equal to four or more four and which are arranged at regular intervals in a circumferential direction of the valve seat member.

2. A proportional solenoid valve according to claim 1,
wherein a total sectional area of all of the exhaust passage
holes is set as one of equal to and twice as large as a seat area
of the seat portion.

3. A proportional solenoid valve according to claim 1,
wherein the input port is provided with an input port orifice
and the input/output-side passage is provided with an
input/output-side passage orifice having a sectional area that is
two to six times as large as a sectional area of the input port
orifice.

4. A proportional solenoid valve according to claim 1,
wherein the input port is provided with an input port orifice
and the output port is provided with an output port orifice having
a sectional area that is two to six times as large as a sectional
area of the input port orifice.

5. A proportional solenoid valve comprising:
an input port to which a fluid is supplied;
an output port that communicates with the input port;
a drain port from which a part of the fluid supplied to the
input port is discharged;
a cylindrical valve seat member that includes an

input/output-side passage provided between the input port and the drain port and between the output port and the drain port, a seat portion that is provided in an end portion of the input/output-side passage, and a drain-side passage provided between the seat portion and the drain port;

a ball-shaped valve element that is brought into and out of contact with the seat portion;

a valve drive portion that includes a coil and displaces the valve element in accordance with a current applied to the coil, thereby changing an amount of the fluid flowing from the input/output-side passage to the drain port through the drain-side passage and changing an output pressure from the output port; and

a cylindrical valve guide portion that is inserted into the valve seat member and guides the displacement of the valve element,

wherein a length of the valve guide portion is set so that when the valve element is brought into contact with the seat portion, a tip portion of the valve guide portion protrudes from a center of the valve element towards the seat portion side by 4% to 14% of a diameter of the valve element.

6. A control method for a proportional solenoid valve provided with: an input port to which a fluid is supplied; an output port that communicates with the input port; a drain port from which a part of the fluid supplied to the input port is discharged; a

cylindrical valve seat member that includes an input/output-side passage provided between the input port and the drain port and between the output port and the drain port and a seat portion that is provided in an end portion of the input/output-side passage; a ball-shaped valve element that is brought into and out of contact with the seat portion; and a valve drive portion that includes a coil and displaces the valve element in accordance with a current applied to the coil, thereby changing an amount of the fluid flowing from the input/output-side passage to the drain port and changing an output pressure from the output port,

the control method comprising:

adjusting a supply pressure to the input port when a temperature of the fluid becomes equal to or higher than a preset temperature so that a pressure difference between the output pressure from the output port and the supply pressure to the input port becomes larger than a pressure difference with which self-induced vibration of the valve element occurs.